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The Complex Challenge of Coyotes

Our natural environment isn't always beautiful, kind, or even pleasant. In fact, it can be extremely harsh and cruel.

One of the less pleasant aspects—predators—doesn't usually concern us. It's easier for most people to identify with rat or starling control problems than coyote control on rangeland.

The U.S. is losing more livestock to predators than any other country for two reasons. We raise most of our livestock on vast ranges with very few caretakers and we have active organized opposition to predator control.

All species of domestic livestock are subject to predators at some time or place. Because of losses to coyotes and other economic problems, the U.S. sheep industry is severely threatened today.

Sheep have unique qualities that cannot be replaced by other livestock. Only sheep can give us wool—highly significant in this age of getting back to naturals and basics. Because of their contributions to food and fiber, their productivity, small size, adaptability and noncompetitiveness with humans, sheep were among the earliest animals domesticated.

Coyotes—*Canis latrans*—are magnificently clever and adaptable. Unlike wolves, they can operate independently or cooperatively. As their numbers increase, they are preying on calves and precious wildlife, as well as sheep and lambs.

The hows and whys of coyote predation is a complex subject. Only recently, scientists have begun intensive studies on basic coyote reproduction. Preliminary research indicates birth control methods for either male or female are a long way from perfection.

In other basic research, ARS scientists are seeking coyote repellents and attractants. No scent or taste is too far out to test—both natural coyote urine fractions and synthetic commercial perfumes. Test results of the best repellents developed so far have been discouraging, however.

A new electric fence (see p. 8) offers the most promise for now. Still, it will be another 2 or 3 years before this fence will significantly affect sheep losses.

Coyote control presents great challenges—both in scientific research and education. Simplistic approaches will neither provide desirable environmental safeguards nor alleviate the damage. Meaningful research, the kind needed to protect both sheep and wildlife, cannot produce results overnight.—*M.M.M.*

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COVER: Can a vegetable plant without resistance to certain insects or diseases be mated to a relative having that resistance even if the two are sexually incompatible? Somatic hybridization—plant breeding without sex—is being tried for cultivated eggplants and their wild relatives after a similar attempt with two tobacco species proved successful (0877X1110–3). Story begins on page 3.

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SOMATIC HYBRIDIZATION—
Removing sex from plant breeding

FUSION OF A SINGLE cell from each of two plants—somatic hybridization—may open a new door to plant hybridization. Theoretically, it could remove sex from plant breeding.

George Fassuliotis, ARS zoologist and nematologist working at the U.S. Vegetable Breeding Laboratory (P.O. Box 3348, Charleston, SC 29407), is trying to transfer root-knot nematode resistance to eggplant from a wild relative. Because the two varieties are not sexually compatible, hybridization cannot be achieved by sexual crossing, so Dr. Fassuliotis is trying the only other possible route—somatic hybridization.

Root-knot nematodes, *Meloidogyne* species, are serious pests on most vegetable crops in the United States. Resistant cultivars are an effective, economical, and environmentally desirable means for controlling the parasites.

Sometimes the use of resistant cultivars is the only means of insuring

Dr. Fassuliotis removes anthers from a wild relative of an eggplant regenerated from a callus culture. Pollen in the anthers will be examined for viability and chromosome number to determine whether or not the plants have mutated in culture (0877X1113–25).

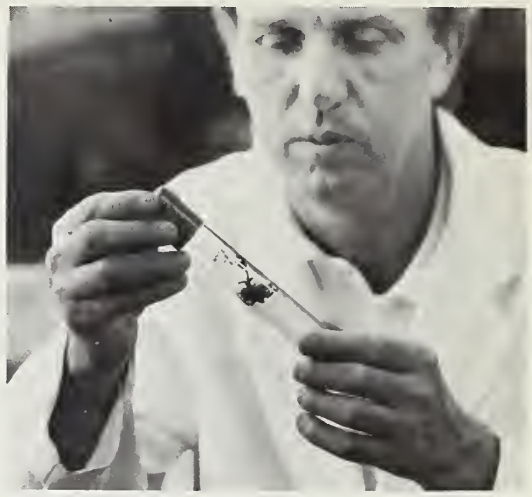
successful crop production, and this route poses no major problems in some plant species. For example, the transfer of resistance in vegetables such as lima bean and the common bean has posed no serious problem because the resistance was found in sexually compatible strains. In other vegetables, such as eggplant and cantaloup, resistance apparently is nonexistent in the cultivated species, but it does occur in distantly related species.

Somatic hybridization is the creation of hybrids with somatic tissue rather than crossbreeding. It involves isolating live cells of both the cultivated species and the resistant wild species and removing the cell walls enzymatically. Then, with either chemical or physical manipulation the nude, or wall-free, protoplasts are fused together into a single new protoplast with all the genetic memory of both original cells.

The new protoplast is placed in a culture medium to grow what is called a callus, which in turn is induced to grow a new plant—a hybrid of the two originals.

In his research to date, Dr. Fassuliotis has successfully grown callus from the wild relative of eggplant and has induced the callus to regenerate whole plants. However, he has been unsuccessful in regenerating whole plants from callus of eggplant.

Callus plants of the wild species were grown to maturity and they produced viable seed. When grown in nematode-infested soil, they exhibited the same high degree of nematode resistance as



Inside a test tube, a wild species of eggplant is started from undifferentiated stem tissue, or callus culture, in a nutrient agar medium. Here, Dr. Fassuliotis checks the regenerated plant to see if it is ready for placement in a larger vessel (cover photograph) for further growth until root formation can be induced, after which it will be replanted in normal soil (0877X1110–19).

Galls on these cultivated eggplant roots are caused by root-knot nematodes. If somatic cells from the eggplant can be successfully fused with those from a wild—but sexually incompatible—relative that is resistant to root-knot, researchers could then transfer the resistance-conferring genes to the cultivated variety (0877X1113–36).

the seed-produced plants. Occasional swellings occurred in the roots, but no adult females or reproduction was found. "Florida Market" eggplant planted at the same time as the callus plants had large galls with gravid females.

The lack of success in regenerating whole plants from cultivated eggplant is considered something of an advantage. In regenerating whole plants via this technique, there are three theoretical possibilities: (1) the sought after hybrid, (2) a regenerated eggplant, or (3) a regenerated wild eggplant relative. The latter two might occur because of a lack of cell fusion. The fact that the cultivated eggplant cannot be regenerated would simply eliminate one element in trying to determine which of the new plants is a product of cell fusion and the desired hybrid.

There are still some obstacles to be overcome in achieving the hybrid, according to Dr. Fassuliotis. Although he has succeeded in fusing protoplasts of distantly related plants, he reported difficulty in inducing the growth of a cell wall around the fused protoplasts. The cell wall is needed for the cell to enter division for growth.—*V.R.B.*

MAKING PROGRESS--PARATUBERCULOSIS CONTROL

CALFHOOD VACCINATION plus recommended management practices may control paratuberculosis in problem herds, a 6-year study in Wisconsin suggests.

Vaccination effectively reduced losses in nine dairy or beef herds where paratuberculosis (Johne's disease) was present and had been for at least 2 years.

Aubrey B. Larsen, an ARS veterinary medical officer at the National Animal Disease Center (P.O. Box 70, Ames, IA 50010), evaluated two killed vaccines. The experimental vaccine made with whole cells proved superior to one made with fractionated cells, he found. Neither vaccine is available through commercial channels.

"We would need to institute all procedures presently recommended for controlling the disease, along with vaccination," Dr. Larsen cautions. These would include good management, including raising calves separately from adults, and good sanitary practices. In the field study, several vaccinated animals developed clinical signs of disease, and others proved to be infected at post-mortem examination.

Killed vaccines effectively protect sheep against paratuberculosis the scientist says, but their usefulness had not been studied extensively in cattle. Recommended management practices reduce losses but usually do not eliminate paratuberculosis in most herds. Neither will test and slaughter procedures similar to those for bovine tuberculosis.

Paratuberculosis is a chronic infectious disease of the intestinal tract of adult cattle. It causes recurrent diarrhea, gradual weight loss, and usually death.

The study involved 539 heifer calves born over a 3-year period and observed until they had delivered their second calves. The project was a joint effort of ARS, the Wisconsin Department of Agriculture represented by Alton I. Moyle, and USDA's Animal and Plant Health Inspection Service represented by Elmer M. Himes.

Approximately a third of the calves received each experimental vaccine, and a third was not vaccinated. Herd owners agreed to notify research cooperators when each calf was born, to feed and care for the experimental animals as part of the herd, to continue existing management practices, and to sell experimental animals only for slaughter.

At slaughter, the scientists diagnosed paratuberculosis in 4 of 41 animals that had received the whole cell vaccine, 14 of 50 given the fractionated cell vaccine, and 31 of 55 not vaccinated.

Scientists obtained data from 146 vaccinated or control cattle sent to slaughter during the 6 years, 114 of them for reasons other than paratuberculosis.

The researchers observed no adverse effects from the vaccine other than nodules at the vaccination site. Dr. Larsen says the nodules did not decrease the animals' value for slaughter but might have affected their value if sold for breeding or milking.

Herds in the study had no history of tuberculosis and none became infected during the 6 years. Vaccination against paratuberculosis is not recommended in herds where tuberculosis exists, Dr. Larsen points out. Hypersensitivity produced by paratuberculosis vaccine can confuse results of the tuberculin test for diagnosing tuberculosis.—*W.W.M.*

Bioavailability Assay

After its meal "spiced" with radioactive zinc, a test rat is placed by Dr. Johnson into a "small animal whole body counter" that will measure the amount of radiation in the rat. Radiation checks are made over a 10-day period to determine how much zinc is actually absorbed by the rat. The same apparatus is used for measuring an animal's absorption of iron, copper, chromium, and any other "gamma emitting" isotope (0677B822–17).

MEASURING THE EXTENT to which zinc from each of numerous foods can be digested, absorbed, and used by animals or humans, while a large task, may not be as formidable now as it has seemed. Scientists call such measurements bioavailability assays.

At the Agricultural Research Service's Human Nutrition Laboratory, Grand Forks, N. Dak., biochemists Gary W. Evans, and Phyllis E. Johnson (P.O. Box 7166 University Station, Grand Forks, ND 58201), conducted studies that may lead to a new standard bioavailability assay—one that is less tedious and time consuming and also more applicable to a wide range of foods. The new information on bioavailability of zinc in foods may help nutritionists greatly improve dietary advice. Absorption of the essential trace minerals varies from zero to nearly 100 percent, says Dr. Evans.

Basically, the discovery that Dr. Evans and Dr. Johnson made was that zinc solution added to a food is as biologically available as zinc that is naturally present in the same food.

In experiments with laboratory rats, the scientists used two conventional methods to measure bioavailability of zinc in cornbread and mush made with corn endosperm flour that was labeled with radioactive zinc. "We found that the two methods produced nearly identical results and that an extrinsic zinc label was metabolized just as well as a less conveniently prepared intrinsic label," said Dr. Evans.

Extrinsic labeling is simply mixing the radioactive zinc with corn flour after it is milled. Intrinsic labeling involves growing corn in a soil-less nutrient solution containing radioactive zinc. Corn for the experiment was grown by plant physiologist Richard H. Hodgson at the ARS Metabolism and Radiation

. a way to measure zinc in foods

Research Laboratory, Fargo, N. Dak.; the endosperm flour was milled by chemists William J. Garcia, Charles W. Blessin, and George E. Inglett at the ARS Northern Regional Research Center, Peoria, Ill.

"In our studies, we also compared extrinsic and intrinsic labeling in foods of animal origin," said Dr. Evans. Rats were fed raw and cooked liver from other rats. Intrinsic-labeled liver was obtained from rats whose food had been mixed with radioactive zinc. The scientists found that the bioavailability of intrinsic-labeled liver was the same as that of extrinsic-labeled liver.

"We were surprised to find that only 32 percent of the zinc in either raw or cooked liver was available while about 65 percent of the zinc in cooked cornmeal was available," said Dr. Evans. Zinc in animal products is generally thought to be more available than zinc in plant products.

Bioavailability of zinc in raw corn flour measured 51 percent. That value compared to 56 percent observed by other researchers who measured bioavailability through long term experiments in which growth responses of rats were observed.

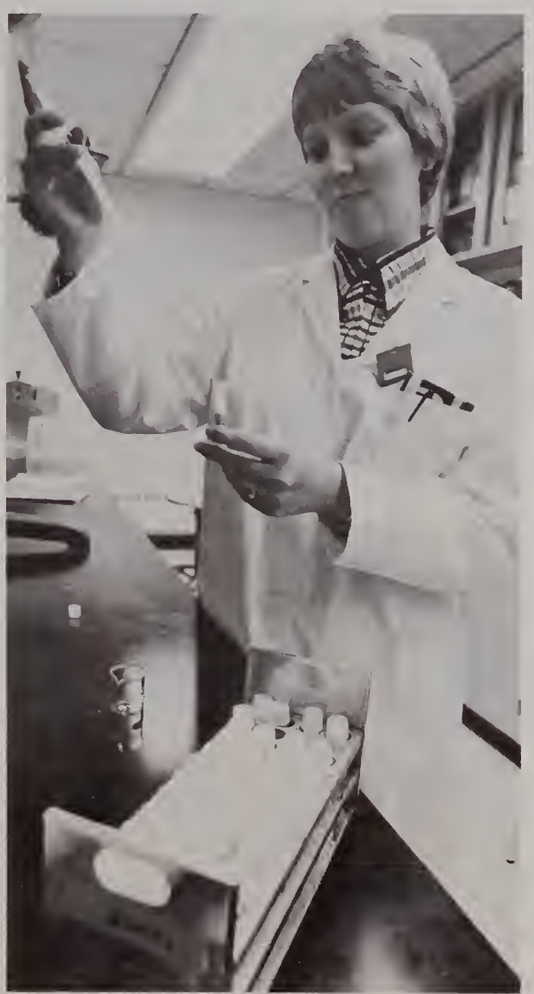
Neither of the two conventional methods used by Drs. Evans and Johnson took more than 3 weeks. One of these methods involved killing the rats and measuring radioactivity of their bodies with digestive tracts removed. The other method involved monitoring the whole bodies of live rats daily for retention of radioactive zinc that they consumed. The scientists modified the latter method, shortening it by 1 week.

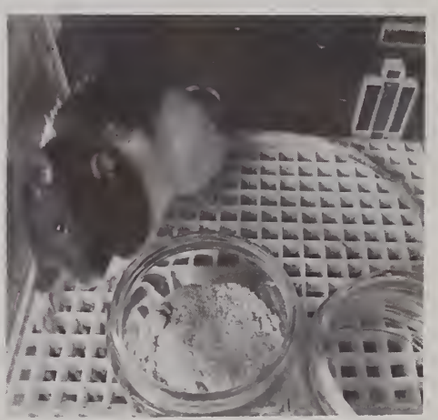
Dr. Evans says the modified method for studying extrinsically labeled food is convenient and versatile. For the first time, individual analyses of many foods are feasible. Since extrinsic labeling is as valid as intrinsic labeling, great efforts are not required to biosynthetically incorporate the radioactive zinc label into food. Another merit of the method is that animals do not have to be sacrificed.

Other researchers are developing a procedure for labeling foods with a nonradioactive zinc isotope and tracing the nutrient's metabolic destinations. This procedure, which would require use of a mass spectrometer, could be used only for studying blood samples, ashed organs, and ashed whole bodies of small animals. "Some day we may be able to make useful comparisons between zinc concentrations in biological materials labeled with radioactive and nonradioactive isotopes," says Dr. Evans.

In other studies, Drs. Johnson and Evans compared concentrations and bioavailabilities of zinc in 7 varieties of milk and 3 infant formulas. "The information that we obtained in studies with rats should be interpreted judiciously with respect to human nutrition," cautions Dr. Evans. Although the bioavailability values may vary between rats and humans, he thinks the rank order of values probably does not vary.

Zinc absorbed from the milks and infant formulas ranged between 0.16 micrograms per milliliter from reconstituted nonfat dry milk to 2.81 micrograms from unprocessed cow's milk. Absorption from human breast milk and from whole processed cow's milk was 1.07 and 1.02 micrograms, respectively.—*G. B. H.*





Above: "Hot" meal: a test rat dines on milled corn and radioactive zinc (zinc-65). Radioactive zinc can be added to the soil where the corn is growing (intrinsic labeling) or to milled corn just before feeding time (extrinsic labeling). The latter procedure allows absorption tests to be conveniently run on zinc in combination with any kind of food (0677B822–20).

***Left:** Dr. Johnson adds a solution of radioactive zinc to human breast milk for tests designed to measure how much zinc in this combination will be absorbed by test animals (0677B824–35A).*

Above: When not charged, this fence presents little obstacle to a hungry coyote. In tests conducted at the Sheep Experiment Station, coyotes invariably penetrated nonelectrified enclosures. When the current was on, however, none of the coyotes could get inside (877X1096–32).

Outfoxing

WILE E. COYOTE had better stick to "beep-beeping" roadrunners because a new type of electric fence—considered a "breakthrough" in research efforts to protect sheep from coyotes in a nonlethal fashion—is now being tested and refined by ARS.

Though coyotes aren't the sole predators of sheep, they are easily the most destructive. Hunting primarily in pairs or as singles, coyotes are responsible for 35 percent of all lamb deaths plus a sizable percentage of adult sheep deaths, according to estimates by USDA's Economic Research Service.

Such losses have cost sheep producers and consumers millions of dollars each year in reduced sales and higher prices. The cattle industry is also beginning to feel the pressure as coyotes are killing more and more calves.

Poisons—once the prime means of controlling predators—have been banned from Federal lands since 1972.

Center: Protected by an electrified fence, these sheep can graze in peace with the complete assurance that any coyote who tries to get at them will be in for the shock of its life (877X1097–15).

Left: Cooperating Idaho State wildlife biologist Roger Woodruff listens for signals from radio-telemetry collars attached to coyotes. The antenna apparatus has a 2-mile "line-of-sight" range on the ground—almost as good as a coyote's "nose" for sheep (877X1098–19).

Coyotes

Nearly half of the West's sheep and lambs graze on Federal lands and since the toxin ban, these flocks have shown the highest rate of lamb losses ever recorded.

Past efforts at coyote-proof fencing failed because the previous fences featured all charged wires. Would-be intruders were not grounded and to receive a shock a predator must be grounded.

The new fence alternates electrified and ground wires from top to bottom—making it impossible for a coyote to avoid simultaneous contact with a charged and a ground wire.

The shock—generated by either a 110-volt or a 12-volt battery energizer—repels but does not injure either coyotes or dogs, or sheep that accidently brush up against the fence.

Invented by Robert Piesse of Melbourne, Australia, who came to this country to demonstrate his work for ARS, the new fence has been adapted to

Above: After a special radio transmission collar is attached, this coyote will be turned loose in a 160-acre test enclosure. Radio telemetry enables researchers to detect whether coyotes are nearby (PN–4146).

our country's needs by ARS veterinarian Norman Gates, at the U.S. Sheep Experiment Station (Dubois, ID 83423).

With Dr. Gates' modifications, the new fence costs considerably less to erect than conventional sheep fencing. To conserve energy and reduce costs even further, Dr. Gates successfully used a wind generator to recharge the battery energizer. He next plans to try a solar-powered energizer which converts rays of the sun into electricity. Wind generators and solar energizers could provide reliable, continual and cheap sources of power for the fence.

As well as keeping coyotes and other predators out, the new fence effectively keeps sheep in! At least 55 percent of all U.S. sheep are kept confined, either on fenced rangeland or on farm flocks. The new fence could replace the conventional fencing currently in use. Having proven 100 percent effective in all ARS tests so far, the new fence offers much-needed relief to beleaguered sheep producers.—*L. C. Y.*

Upper right: *Dr. Gates ensures that wires are taut and adequately secured to the posts. The batteries beside the energizer for this fence are charged entirely by the small "windmill" in the foreground (877X1097–32).*

Lower left: *The coyote skirting this fence won't get to the other side, but some other animals might have to—not to kill sheep, but simply to roam the range. While adult deer would have little difficulty jumping the fence, their fawns probably could not get through. Nor could antelope. Such ecological problems must be considered in the location of electrified fencing (877X1096–27).*

Above: *Dr. Gates checks line voltage at points along electrified fence. A pulsating energizer charges the fence with 3,000 to 5,000 volts about once per second, with each charge lasting about 1/10,000 of a second—long enough to repel, but not kill. On the ground is a charged trip wire to prevent a clever coyote from digging under the fence (877X1097–6).*

This BIG lamb could mean bigger bucks for sheep producers while holding the line on consumer meat prices. An increased supply unaccompanied by comparable production cost increases should keep lamb meat out of the strictly luxury category for most consumers (PN–4150).

The BIG Lamb

CONSUMER SUPPLIES of lamb meat could be increased 25 percent almost immediately and sheep producer profits could also be increased simply by marketing lambs at a heavier weight than they are currently being marketed.

Traditionally, the emphasis for marketing lambs has been on early maturity and fattening. Slaughter weights for western lambs now average 105 to 110 pounds and 95 to 100 pounds for eastern lambs in the belief that at these weights, profits and meat quality are at their best.

While it is true that profit per pound of gain is higher at lighter weights, ARS animal geneticist S. Keith Ercanbrack, U.S. Sheep Experiment Station (Dubois, ID 83423), says that this marketing practice is not the most efficient for western lambs.

According to Mr. Ercanbrack's studies, lamb production can be more profitable for the sheep industry as a whole if ewe lambs are marketed at up to 130 pounds and ram lambs at up to 140 pounds.

As long as the ratio of lamb price to feed cost per pound exceeds the ratio of feed per pound of gain, taking lambs up to heavier slaughter weights can be done economically (excluding labor costs which should be marginal anyway). Under these circumstances the returns will continue to exceed the costs of feeding the animals and the profit per lamb will increase. Slaughter cost per pound of meat is reduced because it costs about the same to slaughter a 145-pound lamb as it does to slaughter a 95-pound lamb.

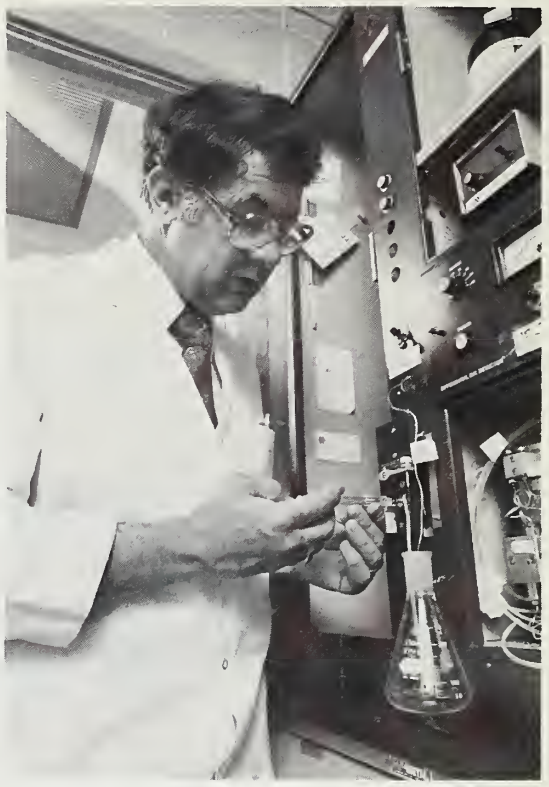
Lamb quality will also be maintained. Tests for such values as tenderness, fat and lean content and taste were run on Rambouillet, Targhee and Columbia purebred and Suffolk crossbred lambs that have been slaughtered at the heavier weights. Quality values were as high for all categories of the heavier lambs as for lighter lambs in the same categories.

Furthermore, preliminary results of consumer studies in cooperation with Utah State University, have shown no difference in consumer acceptability of cuts from heavy and light lambs.

Consumer demand for lamb meat greatly exceeds current U.S. production and, as a result, market prices are rising. Marketing heavier lambs will make available more meat on the market without the necessity of increasing price since profit per lamb will actually be higher simply because of the additional profitable gains.

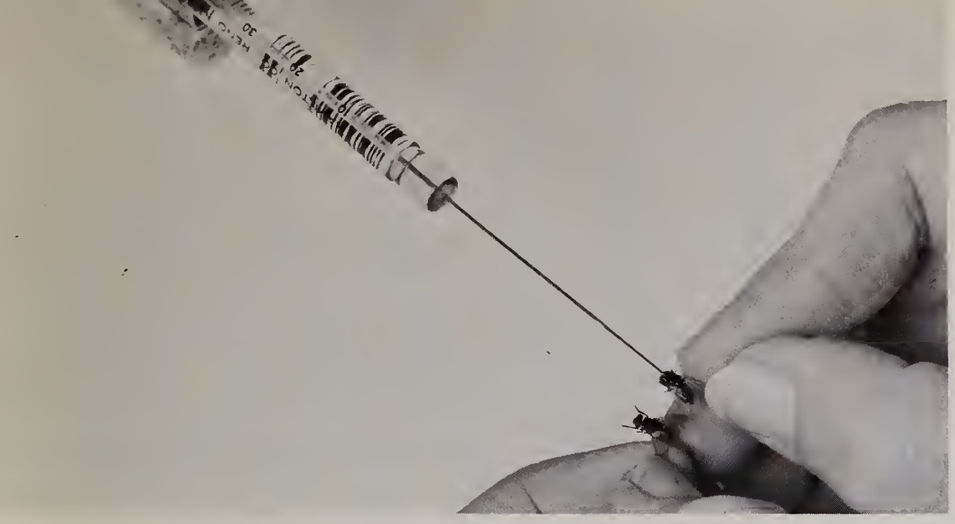
Also, increasing production by marketing "BIG" lambs will cost only about one-half the cost of increasing lamb production by increasing the number of ewes 25 percent.—*L. C. Y.*

Isolating the oöstatic hormone: Dr. Pomonis injects ovarian extract into a liquid chromatograph that will fractionate the substance into its component parts. Hopefully, the oöstatic hormone will be one of them, but its separate existence can be confirmed only through bioassay techniques and reruns through the chromatograph using a variety of solvents. If—or when—the hormone is found and isolated in its pure form, the next step will be to map its molecular configuration. Scientists will then have a compound that can regulate neurosecretions in certain insects. Such knowledge could lead to "autocidal control" (self-destruction) of insects—a new concept in biological control utilizing chemicals from the insect's own body (0677B819–12).



HORMONAL REGULATION. . .
Can It Disrupt Housefly Egg Development ?

Ovaries from a fly are removed for analysis of egg yolk accumulation within them. Inside the egg cytoplasm is the long-sought oöstatic hormone which theoretically prevents release of ovarian activation hormones from the fly's ring gland (0677B818–24).



Above: One micro-liter (3/10 of one millionth of an ounce) of hormonal solution is injected into the thorax of a fly. To facilitate handling, all flies are anesthetized with carbon dioxide. The slightest imprecision could cause the fly to die. Since 1968, over 90 percent of the control flies have survived injection—an unusually high success rate for this type of procedure (0677B816–21).

Right: Dr. Adams scoops eggs from an oviposition cup (actually, an improvised ice cream cup) into holding vials containing 95 percent ethyl alcohol. Spent rearing medium inside the cup is covered by a black cloth soaked with ammonium carbonate—an ideal egg-laying stimuli for houseflies. The egg tissue includes oöcyte cells from which an ovarian hormone can be extracted (0677B817–31).

A HOUSE FLY might not attempt to lay eggs if she were able to understand the complexity of the process.

While she does not, an understanding by scientists of the hormonal stimuli involved in egg-laying may lead to a practical method of disrupting the process. Such a biological control technique has potential against any insect pest that lays eggs in batches.

Entomologist Terrance S. Adams of USDA's Agricultural Research Service has identified a sequence of 10 stages in development of housefly eggs. Development of the first batch has begun when the adult female emerges, and the 10-stage cycle is completed in about 69 hours. By this time, the next batch from her reservoir of 200 to 300 undeveloped eggs has moved down the assembly line to the point where they are ready for yolk formation.

What triggers the sequential operation of the assembly line? Dr. Adams' studies at the Metabolism and Radiation Research Laboratory (P.O. Box 5674, Fargo, ND 58102), indicate that three interacting hormones—neurosecretory material (NSM), the juvenile hormone, and the oöstatic hormone—serve as the "on" and "off" switches.

He says NSM and the juvenile hormone, stored in the ring gland, together function as the "on" switch. Without these hormones, egg development cannot proceed to yolk formation—beyond stage 4. The exact functions of NSM and juvenile hormone are yet to be explained.

The oöstatic hormone, produced by the developing ovary, serves as the "off" switch. It provides feedback information to the ring gland, preventing further release of NSM. If ovaries are removed after egg-laying, NSM synthesis and release continue.

Since 1967, technician Geneva Olstad has injected some 140,000 house flies for bioassay of the oöstatic hormone and has prepared extracts from an additional 500,000 flies. This work has explained much of how these hormones regulate egg development.

Newly emerged flies, Dr. Adams explains, are in a resting phase. The ring gland is large and filled with NSM, synthesis of NSM is occurring, and the ovary contains stage 2 eggs. Activation occurs when eggs are in stage 3 or 4. NSM and juvenile hormone are then released from the ring gland, he says, with an accompanying decrease in ring gland volume.

The juvenile hormone, NSM, or the two hormones together then initiate yolk formation by the ovary. They also stimulate production of oöstatic hormone, which prevents further NSM release. Supplies of NSM and juvenile hormone build up to original levels by the time the fly contains mature eggs. Egg-laying then activates the next cycle with another batch of eggs.

In 1968 Dr. Adams first suggested that an ovarian hormone, which he termed the oöstatic hormone, must have the role in egg development confirmed in later studies. Other investigators have since isolated similar ovarian hormones from the mosquito and assassin bug.

ARS chemist J. George Pomonis and Dr. Adams have now partially purified extracts with hormonal activity from ovaries containing mature eggs and from eggs laid by virgin flies. The latest step confirms production or production and storage of the oöstatic hormone in the protoplasm of the egg.

The next and obviously difficult step will be finding a way to inactivate one of the "on" and "off" switches that regulate the egg-developing assembly line. Dr. Adams has a quarter-million house fly ovaries in the freezer for use in future studies.—*W.W.M.*

Noisy Cotton Gins

Noise is a serious problem in cotton ginning systems, and noise abatement is essential to the health and job performance of ginning workers. Lint cleaners located in or near operator work areas are a major source of high noise levels. Reducing or even eliminating noise from lint cleaners would not necessarily reduce the noise level in operators' work areas to below 80 dBA. (dBA is a unit of measurement for defining the loudness of sounds.) It would, however, be a significant first step in reducing high noise levels.

Lint cleaners remove small trash from lint cotton and remove lint cotton from the saw cylinder with a doffing brush. The brush cylinder is a major contributor to the noise produced by lint cleaners. The standard brush cylinder acts as a centrifugal fan and the brush sticks (rows of bristles) act as fan blades. High noise levels are produced as each brush stick passes a cutoff point (plane) which extends the length of the brush cylinder and forces cotton from the lint cleaner and on to the next processing stage.

W. Stanley Anthony of U.S. Cotton Ginning Research Laboratory (P.O. Box 256, Stoneville, MS 38776), built three experimental brush cylinders (staggered, helical, and spiral) and compared these with the standard brush cylinder in the lint cleaner. Comparisons were made with and without cotton in the ginning operation. When the brush cylinders and motor only were operated, the staggered and helical brush cylinders were not consistently less noisy than the standard brush cylinder. At the recommended operating speed of 1,200 rpm the spiral brush cylinder produced 91 percent (15.5 dBA) less noise than the standard brush cylinder.

Noise levels of 90.5 and 86.5 dBA occurred from the use of standard and spiral brush cylinders respectively, when cotton was processed through the system. The lower noise level from the use of the spiral brush cylinder made noise from other ginning equipment more detectable. Additional research for lowering the noise levels of other gin equipment is needed and is underway.—*E. L.*

Flight of the Weevil

No crowd applauded the takeoff, but weevils—*Diaprepres abbreviatus* (L.)—were found 9 days later 236 meters (m) from the starting line.

Knowledge of the flight behavior and adult dispersal of this citrus-attacking weevil will help entomologists to establish badly needed biological and chemical control programs.

First found infecting citrus groves near Apopka, Fla., in 1974, the so-called surgarcane rootstalk borer weevil was quarantined in an area of about 2,000 hectares (ha), later extended to encompass about 13,350 ha by 1975. The metric hectare is equal to 2.47 acres.

In 1975 an infested area was also found near Forest City, Fla., and an additional, 2,400 ha were placed under quarantine.

Releases of the field-collected, paint-coded weevils were made from a common point in a 20-ha isolated 'Hamlin' orange grove near Apopka; adults were placed on a 0.3-m-high box placed in the center of a row. Flight of adults was observed at each release date and the distance some adults flew was measured and recorded.

The first observations were made 4 hours after release and subsequent observations were made at daily intervals during the first week.

In a second test, weevils were observed later at various distances from the release site from 5 to 52 days after release.

Adults were observed at 10 m after 5 days, up to a maximum of 208 m at 31 days. One female was observed 175 m at 52 days.

Most weevils flew directly to the nearest tree or landed on weeds around the canopy of the tree. Those flying 38 to 45 m, the maximum distance observed, flew about twice the tree height and appeared to hover for a few seconds before landing. When disturbed, some adults feigned death by dropping to the ground and remaining motionless.

Entomologists Joseph B. Beavers and Allen G. Selhime at the U.S. Horticultural Research Laboratory (2120 Camden Rd., Orlando, FL 32803), concluded that *D. abbreviatus* is capable of strong flight for short duration and distances.

"As indicated by the locations of the weevil-infested groves within a quarantine area and by the distance separating the two quarantine areas, they are also transported mechanically. They conveniently light on plant material, grove machinery, and fruit-carrying trucks," says Mr. Beavers.—*P. L. G.*

Nectariless Cottonseed—Can We Eat It?

NECTARILESS COTTON VARIETIES were originally developed for their value in suppressing tobacco budworms and bollworms. With increased commercial acceptance of nectariless cotton more needs to be known about the chemical composition and food value of cottonseed from nectariless varieties. In view of this and of the increased use of cottonseed protein products as protein supplements and food extenders, researchers are studying the nitrogen composition and amino acid value of seed from nectariless cotton.

In two different experiments C. D. Elmore, W. R. Meredith, Jr., and E. E. King of the Cotton Physiology and Genetics Laboratory (P.O. Box 225, Stoneville, MS 38776), and C. D. Ranney, Area Director (P.O. Box 1486, Starkville, MS 39759), compared cottonseed of nectariless and nectaried varieties for nitrogen composition and amino acid content. Analysis of the data revealed that the nectariless trait has no significant effect upon nitrogen concentration in the seed and there is little significant difference in amino acid content of seed from nectariless and nectaried varieties.

Seeds from nectariless cottons averaged 5.42 percent nitrogen compared with 5.39 percent for nectaried varieties. Although five amino acids were higher in seed of nectariless cotton, the differences were small and of little apparent practical significance. Differences among cultivars for lysine and tyrosine were somewhat more significant. Since cultivars differ for protein content and some amino acids are correlated with protein within cultivars, then a change in protein content could result in a significant change of amino acids among cultivars.

The results indicate that no detrimental effect upon seed quality or seed performance should occur whenever a cultivar is converted to nectariless. The study does suggest that there are cultivar differences for nitrogen content and amino acid composition and these may very well be genetically manipulated in cotton breeding programs to produce better quality cottonseed.—*E. L.*

Pecan Harvester for Small Orchards

A MUCH-NEEDED, inexpensive pecan harvester for orchards of 5 to 25 acres has been developed and tested by ARS agricultural engineers.

The harvester, driven by a garden-size tractor, sweeps up pecans in a 40-inch wide path at a rate of ⅓ acre per hour.

Pecan recovery is better than 90 percent, which is comparable to commercial harvest equipment and probably better than hand harvesting. For best results orchard floors should be smooth and either bare of ground cover or clipped to about 3 inches or less.

Trash content, mainly small twigs the size of pecans, was 45 percent. This was the first time the orchard was harvested by machinery and the engineers feel the trash content will be lower in succeeding years. In any event this is within the normal 33- to 50-percent range ordinarily encountered in mechanical pecan harvesting.

The new unit utilizes a 22-inch diameter rubber-fingered screw that sweeps the nuts and other material along the ground to one side and then up an inclined surface to an elevating conveyor for movement to a sack or other container. As the material is moved along, leaves and some of the trash are removed at two points by streams of air.

Developed by Donald L. Peterson and Gordon E. Monroe at the Southeastern Fruit and Tree Nut Research Laboratory (P.O. Box 87, Byron, GA 31008), the harvester is expected to be a valuable economic aid to small pecan farmers.

As projected by the engineers over a 10-year period, the annual overhead cost including the initial cost, interest, maintenance, and repairs of the harvester plus 50 percent of the cost of a tractor, should be about $375. Total operating costs would be $3 per hour, assuming 50 cents per hour for fuel and $2.50 per hour for the operator.

When projected for 10 acres, based on a 1,000 pound per acre crop, the per pound harvest cost would be about 5 cents per pound plus 1 cent per pound for cleaning, as opposed to about 8 cents per pound for hand harvesting.—*V. R. B.*

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Recognizing Smut

NEW, IMPROVED, quicker ways to identify dwarf smut may help restore lost wheat export markets to the Pacific Northwest of the United States.

Wheat shipment has ceased from the Pacific Northwest to foreign countries that totally ban dwarf smut. Though dwarf smut, a wheat fungus that occurs in this country only in the Pacific Northwest, has no effect on humans, it does reduce wheat quality and yield.

One of the problems may be that under visual inspections, common and grass smut, which already exist in the quarantining countries, may be mistaken for dwarf smut. When viewed under a microscope, spores of all three smuts are so similar in appearance that even experts often cannot distinguish one from another.

ARS chemist Edward J. Trione (Oregon State University, Room 2080, Corvallis, OR 97331), has devised several methods of testing for dwarf smut that use chemical differences between the various smut strains to make an identification. His methods have proven much more accurate than visual inspections.

Grain inspectors, in fact, are already using two of Dr. Trione's tests—an alcohol test and a negative stain test—to monitor wheat shipments. In alcohol, dwarf smut spores appear spherical, while spores from the other two smuts appear distorted. If the background of a dwarf smut spore on a microscope is stained, a halo around the spore appears. No such halo appears with the other two smuts.

The alcohol and the negative stain tests are nearly 100 percent effective, require only a few spores, and can be done within 30 minutes. Dr. Trione has also developed three other methods of identifying dwarf smut, but these methods require larger samples and more time to complete, and might best be used as backups to confirm any ambiguous results from the first two tests.—*L.C.Y.*

Cold Tolerant Sugarcane

SUGARCANE GROWERS are constantly in need of more cold tolerant, commercial sugarcane varieties to combat damage caused by extensive freezing in winter. Freeze damage to cane has occurred in Argentina, Australia, Brazil, China, India, Japan, Mexico, Morocco, Pakistan, Rhodesia, South Africa, Spain, Taiwan, and the United States.

Field testing for cold tolerance has had little success because of the erratic occurrence of freezes in sugarcane areas and the variability of duration, temperature, and post-freeze conditions. To achieve more controlled conditions for testing cold tolerance, plant physiologist James E. Irvine of the U.S. Sugarcane Field Laboratory (P.O. Box 470, Houma, LA 70360), conducted refrigerated freezing tests to find cold tolerant sugarcane varieties.

Commercial sugarcane hybrids were compared with 28 wild clones of *S. spontaneum*, two natural hybrids, six experimental hybrids, and clones of *Ripidium*, *Miscanthus*, and *Sclerostachya*. Plants were exposed at 27° F (−2.8° C) for 12 hours and at 24° F (−4.4° C) for 3 hours.

The cold treatments caused complete freezing of above ground portions of many clones, including some commercial ones. Clones surviving these treatments did so repeatedly and were clearly superior in cold tolerance. Cold tolerance was observed in some thin-leafed, thin-stemmed clones of *S. spontaneum*, *Ripidium*, and *Miscanthus*. Sprouting ability was generally related to cold tolerance.

The experiments revealed that cold tolerance greater than that found in commercial clones is available in wild sugarcane plants. The survey suggests that plant breeders continue efforts to collect, screen, and incorporate germplasm transmitting superior cold tolerance.—*E. L.*

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